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SECTION I: CHAPTER 2

SAMPLING FOR SURFACE CONTAMINATION

A. INTRODUCTION

The terms wipe sampling, swipe sampling, and smear sampling are synonyms that describe the techniques used to assess surface contamination. “Wipe sampling” will be the term used in this chapter.

Wipe sampling is most often used to determine the presence of asbestos, lead and other metals, aromatic amines, and PCBs.

The uses of wipe sampling include:

- **Skin Sampling**

To evaluate workers contact with surface contaminants.

Skin wipes are not recommended for substances that are absorbed rapidly through the skin. Biological monitoring for these substances or their metabolites or biological markers is often the only means of assessing their absorption.

- **Sampling of Surfaces**

Surfaces that may come into contact with food or other materials that are ingested or placed in the mouth (e.g., chewing tobacco, gum, cigarettes) may be wipe sampled (including hands and fingers) to detect contamination.

Contaminated smoking materials may allow toxic materials or their combustion products to enter the body via the lungs (e.g., lead, mercury). Wiping of surfaces that smoking materials may touch (e.g., hands, fingers) may be useful in evaluating this possible route of exposure.

Accumulated toxic materials can become suspended in air and may contribute to airborne exposures (e.g., asbestos, lead, or beryllium). Bulk and wipe samples may help assess this possibility.

- **Sampling of Personal Protective Equipment**

Effectiveness of personal protective gear (e.g., gloves, aprons, respirators) may be evaluated by wipe sampling the inner surfaces of the protective gear (and protected skin).

Effectiveness of decontamination of surfaces and protective gear (e.g., respirators) can be evaluated by wipe sampling.

When accompanied by close observation of the operation in question, wipe sampling can help identify sources of contamination and poor work practices.

EVALUATION OF SAMPLING RESULTS

- False negative results, i.e., when surface contamination is not detected by a wipe sample, are possible.
- The IH/SE must use professional judgment on a case by case basis when evaluating the significance of positive wipe-sampling results.
- When evaluating results, consider the toxicity and the contribution of skin absorption and/or gastrointestinal absorption to the total dose. Additional factors are the ambient-air concentrations, skin irritation, etc.

The OSHA Computerized Information System (OCIS) Chemical Sampling Information lists substances that have a potential for ingestion toxicity, skin absorption, and/or a hazardous effect on skin. This information may be found under the "Health" notation. Additional toxicological information concerning chronic skin absorption, dermatitis, etc. should be used in determining if the resulting exposure presents a potential employee hazard (see Bibliography).

B. GENERAL TECHNIQUE FOR WIPE SAMPLING

FILTER MEDIA AND SOLVENTS

Consult the OCIS Chemical Sampling Information for appropriate filter media and solvents. Dry wipes may be used. Solvents are not always necessary but may enhance removal.

Direct skin wipes should not be taken when high skin absorption of a substance is expected. Under no conditions should any solvent other than distilled water be used on skin, personal protective gear that comes into direct contact with the skin, or surfaces that come into contact with food or tobacco products.

Generally, two types of filters are recommended for taking wipe samples:

- Glass fiber filters (GFF) (37 mm) are usually used for materials that are analyzed by high-performance liquid chromatography (HPLC), and often for substances analyzed by gas chromatography (GC). The OCIS Chemical Sampling Information specifies when GFFs are to be used.
- Paper filters are generally used for metals. For convenience, the Whatman smear tab (or its equivalent) or polyvinyl chloride filters for substances that are unstable on paper-type filters are commonly used. (See the OCIS Chemical Sampling Information on specific sampling and analytical methods for details.)

Preloading a group of vials with appropriate filters is a convenient method. (The Whatman smear tabs should be inserted with the tab end out.) Always wear clean plastic gloves when handling filters. Gloves should be disposable and should not be powdered.

PROCEDURE

Follow these procedures when taking wipe samples:

- If multiple samples are to be taken at the worksite, prepare a rough sketch of the area(s) or room(s) to be wipe sampled.
- Use a new set of clean, impervious gloves for each sample to avoid contamination of the filter by the hand (and the possibility of false positives) and prevent contact with the substance.
- Withdraw the filter from the vial. If a damp wipe sample is desired, moisten the filter with distilled water or other solvent as recommended in the *Chemical Information Manual*.

CAUTION

Skin, personal protective equipment, or surfaces that come into contact with food or tobacco products must be wiped either DRY or with distilled water, never with organic solvents. Skin wipes should not be done for materials with high skin absorption. It is recommended that hands and fingers be the only skin surfaces wiped. Before any skin wipe is taken, explain why you want the sample and ask the employee about possible skin allergies to the chemicals in the sampling filter or medium. If the employee refuses, do not force the issue.

- Wipe a section of the surface to be sampled using a template with an open area of exactly 100 cm². (See Appendix I:2-1.)
- For surfaces smaller than 100 cm(2) use a template of the largest size possible. Be sure to document the size of the area wiped. For curved surfaces, the wiped area should be estimated as accurately as possible and then documented.
- Maximum pressure should be applied when wiping.
- To ensure that all of the partitioned area is wiped, start at the outside edge and progress toward the center by wiping in concentric squares of decreasing size.
- If the filter dries out during the wiping procedure, rewet the filter.
- Without allowing the filter to come into contact with any other surface, fold the filter with the exposed side in, then fold it over again. Place the filter in a sample vial; cap, number and seal it. Note the number at the sample location on the sketch. Include notes with the sketch giving any further description of the sample (e.g., "Fred Employee's respirator, inside;" "Lunch table").
- At least one blank filter treated in the same fashion, but without wiping, should be submitted for each sampled area.
- Submit the samples to the analytical laboratory with a Cal/OSHA 1H form.

C. SPECIAL TECHNIQUE FOR WIPE SAMPLING

ACIDS AND BASES

When examining surfaces for contamination with strong acids or bases, (e.g., hydrochloric acid, sodium hydroxide), pH paper moistened with water may be used. However, results should be viewed with caution due to potential interference.

DIRECT-READING INSTRUMENTS

For some types of surface contamination, direct-reading instruments may be used (e.g., mercury sniffer for mercury).

AROMATIC AMINES

Screening may determine the precise areas of carcinogenic aromatic amine contamination. This is an optional procedure. (See Appendix I:2-2.)

D. SPECIAL CONSIDERATIONS

Due to their volatility, most organic solvents are not suitable for wipes. Other substances are not stable enough as samples to be wipe sampled reliably. If necessary, judge surface contamination by other means, (e.g., by use of detector tubes, photoionization analyzers, or other similar instruments). Consult the OCIS Chemical Sampling Information.

Some substances should have solvent added to the vial as soon as the wipe sample is placed in the vial (e.g., benzidine). These substances are indicated with an "X" next to the solvent notation in the OCIS Chemical Sampling Information.

Do not take surface wipe samples on skin if:

- OSHA or ACGIH shows a "skin" notation and the substance has a skin LD₅₀ of 200 mg/kg or less, or an acute oral LD₅₀ of 500 mg/kg or less; or
- the substance is an irritant, causes dermatitis or contact sensitization, or is termed corrosive.

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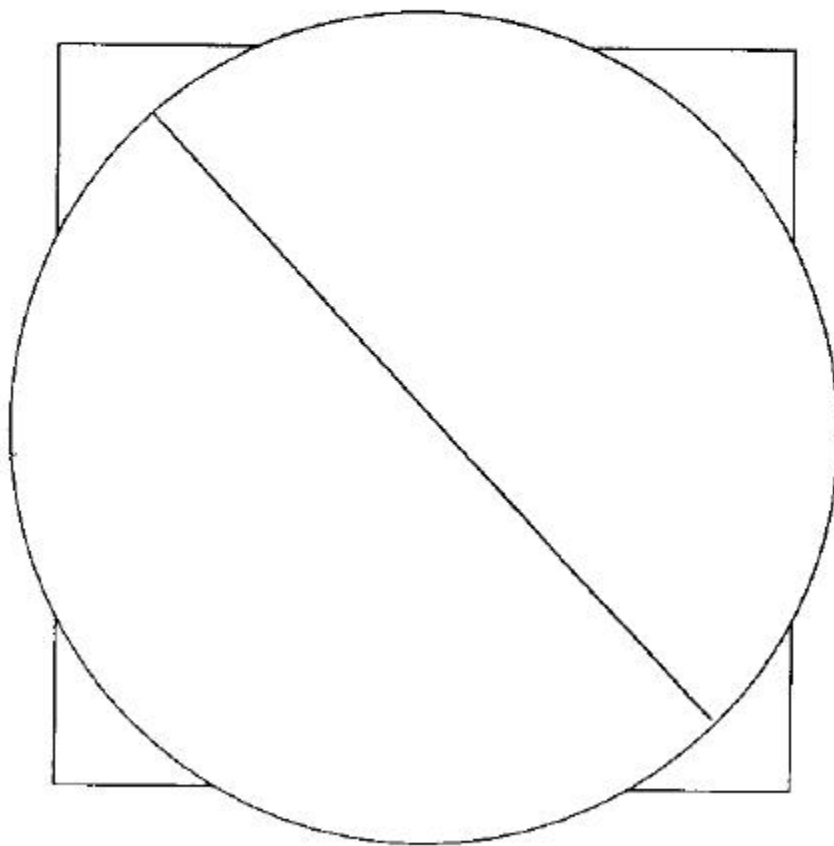
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**APPENDIX I:2-1. TEMPLATE SAMPLES THAT COVER
100 SQUARE CENTIMETERS**

DIAMETER OF THE CIRCLE IS 11.2 CM.



THE SIDES OF THE SQUARE ARE 10 CM.

APPENDIX I:2-2. FLUORESCENT SCREENING FOR CARCINOGENIC AROMATIC AMINES

As in the case of routine wipe sampling, wear clean, disposable, impervious gloves. Wipe an area of exactly 100 cm² with a sheet of filter paper moistened in the center with 5 drops of methanol.

After wiping the sample area, apply 3 drops of fluorescamine (a visualization reagent supplied by the analytical laboratory upon request) to the contaminated area of the filter paper.

Place a drop of the visualization reagent on an area of the filter paper that has not come into contact with the surface. This marks a nonsample area or blank on the filter paper adjacent to the test area.

After a reaction time of 6 minutes, irradiate the filter paper with 366 nm ultraviolet light.

Compare the color development of the sample area with the nonsample or blank area. A positive reaction shows yellow discoloration that is darker than the yellow color of the fluorescamine blank.

A discoloration indicates surface contamination, possible aromatic amine carcinogen. Repeat a wipe sampling of the contaminated areas using the regular surface contamination procedure.

The following compounds are some of the suspected carcinogenic agents that can be detected by this screening procedure:

- 4,4'-methylene bis(2-chloroaniline)
- benzidine
- alpha-naphthylamine
- beta-naphthylamine
- 4-aminobiphenyl.

ALTERNATE SCREENING METHODS FOR AROMATIC AMINES

The analytical laboratory is testing commercially available kits with wipe pads that contain an aromatic amine indicator. Preliminary evaluations show them to be an adequate screening tool. Their detection limit is approximately 5.0 µg/100 cm². These kits are more convenient than the fluorescent procedure outlined above, and they eliminate the added hazard of handling fluorescamine. Kits will be available for Cal/OSHA staff from the analytical laboratory.

The following compounds are among the suspected agents that can be detected through this screening procedure:

methylenedianiline (MDA)
4,4'-methylenebis(2-chloroaniline)
benzidine
 α -naphthylamine
 β -naphthylamine
4-aminobiphenyl
o-toluidine
aniline
2,4-toluediamine
1,3-phenylenediamine
naphthylenediamine
2,4-xylylene
o-chloroaniline
3,4-dichloroaniline
p-nitroaniline.